Uses of Tiered Significance Levels in NEPA Documents

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INTRODUCTION

The significance of environmental impacts plays a key role in how agencies of the Federal government implement the National Environmental Policy Act (NEPA).[1] Section 102 of NEPA establishes a requirement that agencies include a detailed statement of the environmental impacts (environmental impact statement, or EIS) of "proposals for legislation and other major Federal actions *significantly* (emphasis added) affecting the quality of the human environment".[2] The Council on Environmental Quality (CEQ) has established a process by which agencies can identify categorical exclusions allowing for expedited NEPA documentation for "categories of actions which do not individually or cumulatively have a *significant* (emphasis added) effect on the human environment…"[3]. CEQ also allows agencies to prepare "Findings of No Significant Impact" (FONSIs) in lieu of EISs for actions lacking potentially significant impacts.[4] CEQ has developed limited but useful direction on evaluating the possible significance of environmental impacts calling for an integrated consideration of "context and intensity".[5] Caselaw has established that agencies must supplement an EIS only if there is new information indicating that a previously evaluated action "will affect the quality of the human environment in a *significant* (emphasis added) manner or to a *significant* (emphasis added) extent not already considered.[6]

Most agencies distinguish between impacts that are significant and those that are not significant. Few however have attempted to more finely classify impacts on the basis of significance. The tendency has been to identify each environmental impact as either significant or not significant and then focus on those impacts passing this initial significance screen. A more analytical approach would be to recognize impacts as occurring on a spectrum of significance. Somewhere on this spectrum a threshold would theoretically exist above which an impact would be significant; however, it may not always be possible to sharply delineate a meaningful threshold. Impacts may lie above or below the threshold, but those falling closer to the threshold may display intermediate stages of significance that still warrant further consideration. Expressed mathematically, significance could perhaps be better expressed as a smooth curve representing a

continuous distribution rather than as a simple two-point discrete distribution. Impacts whose significance is substantially greater than the threshold could warrant greater subsequent focus than impacts only slightly above the threshold; impacts whose significance falls just under the threshold may not warrant being discounted as impacts clearly falling short. The need for evaluating impacts in the context of a continuous distribution could be especially apparent when considering cumulative impacts; multiple impacts falling just below the threshold of significance can more rapidly escalate to cumulative significance than multiple impacts falling well below the threshold.

In contrast to the simplistic tendency described above, one agency that prepares multiple EISs annually, the U.S. Nuclear Regulatory Commission (NRC), recognizes three rather than two levels of possible significance. Rather than merely identifying environmental impacts as significant or not significant, NRC identifies impacts as SMALL, MODERATE, or LARGE in its EISs, using the following definitions:[7]

> SMALL – Environmental effects are not detectable or are so minor that they will neither destabilize nor noticeably alter any important attribute of the resource.
>
> MODERATE – Environmental effects are sufficient to alter noticeably, but not to destabilize, important attributes of the resource.
>
> LARGE – Environmental effects are clearly noticeable and are sufficient to destabilize important attributes of the resource.

The three NRC significance levels are delineated on the basis of what constitutes a "noticeable" impact (delineates SMALL from MODERATE) and a "destabilizing" impact (delineates MODERATE from LARGE). The interpretation of what is "noticeable" or "destabilizing" is no less subjective than the interpretation of what is "significant", although the expanded palette of possible conclusions allows for an expanded ability to resolve differences. Having three rather than two possible

significance determinations conveys more information by way of a single conclusory word.

Interestingly, the NRC definitions do not identify a point where the traditional NEPA significance threshold lies. Clearly, SMALL impacts are not significant and LARGE impacts are significant. The NEPA significance threshold must theoretically therefore fall somewhere within the range of MODERATE impacts, somewhere between the point where an impact becomes noticeable and where it causes environmental destabilization.

The following analysis examines the advantages and challenges of using the NRC three-stage sequence of significance levels instead of the traditional two-stage approach of significant versus not significant. It explores how the NRC system might be expanded to develop an even more precisely graduated system of significance levels and how such a system might be useful in future NEPA practice. It also evaluates several potential advantages and disadvantages of utilizing such a graduated system in place of the traditional absolute system. The analysis builds upon an oral presentation given by the author at the 39th Annual Conference of the National Association of Environmental Professionals.[8]

BACKGROUND

The concept of significance has come to pervade NEPA practice. However, the word "significant" (and its inflected forms, e.g., significantly) appears only once in the NEPA statute. Section 102 (1) (C) of NEPA states that all agencies of the Federal Government shall:

> Include in every recommendation or report on proposals for legislation and other major Federal actions *significantly* [emphasis added] affecting the quality of the human environment, a detailed statement by the responsible official on…[9]

In other words, NEPA requires Federal agencies to prepare EISs only for substantive proposed actions that might affect the environment to a meaningful extent. But what does it mean to *significantly* affect the environment? Clearly, the authors of the statute did not intend for agencies to prepare EISs just because an action might have *some* impact on the environment. They undoubtedly thought that the direction to prepare EISs only for "major" Federal actions "significantly" affecting the environment provided adequate guidance to prevent agencies from spending resources on purposeless EISs for trivial actions. The process received greater formalization with the establishment of the categorical exclusion[10] and the environmental assessment (EA)[11] and finding of no significant impact (FONSI)[12] by CEQ in 1978. Introduction of these expedited NEPA compliance processes elevated the importance of significance; successful demonstration of a lack of significance could save agencies substantial time and effort when complying with NEPA.

Even though CEQ elevated the role and importance of significance in NEPA practice, it offered little concrete guidance on how to assess significance. What little guidance it offered was presented under its definition of the term "significantly", where it stated that use of that term in NEPA "requires considerations of context and intensity".[13] Context refers to the spatial and temporal setting of an action.[14] Intensity refers to the impact's severity based on consideration of ten factors.[15] Some of the factors refer to specific resources, e.g., historic or cultural resources, wetlands, and public health and safety; while others refer to specific analytical considerations, e.g., risk or controversy. CEQ offered no quantitative guidance. Despite the specificity of how CEQ defined context and the ten intensity factors, CEQ in no way removed subjective judgment from the process of evaluating significance for NEPA.

The word "significant" is a relatively simple and widely recognizable word outside of NEPA and other environmental contexts. Merriam-Webster's online website offers a summary definition as follows:

- large enough to be noticed or have an effect

- very important

- having a special or hidden meaning[16]

A variety of terms exist to describe concepts of less than significance: minor, minimal, trivial, miniscule, small, unnoticeable, and inconsequential. Clearly, effects that justify any of these terms do not rise to the level of significance. The element of noticeability is particularly relevant, considering the role of noticeability in delineating the NRC conclusions of SMALL and MODERATE.

The word significant also plays a key role in statistical analyses, including those performed as part of technical investigations sometimes cited in NEPA documents. Used in a statistical context, significance is a strictly mathematical concept pertaining to the probability of replication of differences in the outcome of experimental trials. It conveys no information regarding the meaningfulness or relevance of information revealed by an experiment. It may be possible through careful experimental design and exhaustive replication of observational events to demonstrate that the application of multiple exposures of some sort results in statistically significant differences in the response of some test organism. But that difference may not be great enough in a practical context to represent a meaningfully significant observation. One statistical website cautions researchers not to "use the word 'significant' to describe a finding that may have decision-making utility to a client" and to always use the term "statistical significance" when referring to significance in a purely statistical context.[17]

The dictionary definition of significance presented above encompasses elements of importance and noticeability. It also implies a threshold: large enough. Having a threshold implies some underlying quantitative basis, although casual use of the word is rarely connected with actual measurement. It is this threshold that CEQ fails to offer; NEPA practitioners are instead forced to rely on their technical knowledge and scientific judgment to determine where the threshold lies. That determination might consist of

some numerical setpoint for one or more quantitative metrics (e.g., significance is reached when the estimated population of an endangered species falls below a certain number of individuals) or might comprise a more qualitative or conceptual threshold (e.g., significance is reached the population of a species is reduced to levels where it might not be able to sustain itself indefinitely in the surrounding landscape). Such an approach would resemble that used for development of recovery plans under the Endangered Species Act[18]. Guidance for development of recovery plans calls for development of recovery criteria that are "specific, measureable, achievable, realistic, and time-referenced."[19] As an example, the guidance references three recovery criteria for the piping plover (*Charadrius melodus*) calling for attainment of a minimum of 2,000 breeding pairs among four geographically defined populations (recovery units) and achievement of a five-year average productivity of 1.5 fledged chicks per pair in each unit.[20] These clearly defined quantitative setpoints sharply and meaningfully delineate recovery from non-recovery, which lies at the heart of the Endangered Species Act's objectives.

Such quantitative thresholds are rarely available to define significance in the context of NEPA. However, the fact that NEPA practitioners must rely on their own intuition, gained over years of education and experience, rather than relying on simple referral to preset quantitative setpoints may not be a bad thing. Practitioners must weigh evidence from multiple sources and carefully consider the context, applicability, and reliability of each source to arrive at a meaningful overall conclusion. This is NEPA at its best: a planning and decisionmaking process, not a standard operating procedure following some lockstep sequence of actions laid out in a handbook.

The seemingly casual wording in the NEPA statute regarding significance may be telling today's NEPA practitioners something: the founders of NEPA may have never intended for significance to play as large a role as it now does in NEPA practice. The CEQ emphasizes that alternatives, not significance, lie at the heart of an EIS.[21] An EIS is in essence a comparative document that compares the environmental effects of one alternative against those of another, not against some preset notion of significance. The

environmentally preferable alternative may have no significant impacts or a lot of significant impacts; if an alternative meets the purpose and need of the proposed action with the least environmental impacts then it's choice is an environmentally informed and likely a desirable decision[22]. According to CEQ, the objective of NEPA is "not to generate paperwork – even excellent paperwork – but to foster excellent action."[23] In other words, the objective of NEPA is excellent decisions, not excellent documents. Parsing fine differences among various terms for significance will only further the objectives of NEPA if it serves to foster better consideration of alternatives and therefore foster better decisionmaking.

SIGNIFICANCE LEVELS IN NRC EISs

As stated above, NRC does not explicitly state how its NEPA significance levels compare to the traditional NEPA approach regarding the simple presence or absence of significance. Table 1 provides an interpretation but is not based on official agency direction. There is little room for debate that SMALL corresponds to a lack of significance and that LARGE corresponds to significance. Any uncertainty surrounds the MODERATE designation. The basis for the designation is noticeability. Intuitively, something can be noticeable without being significant. In a general context, the concept of being "noticeable" is defined based on the capability to attract attention.[24] There is no implication that a noticeable event is necessarily of substantial importance. Still, the concept of being noticeable does at least approach the concept of being significant. The relative heights of the cells in Table 1 are not accidental; impacts designated as MODERATE in NRC's EISs tend to be significant as well, but one can still intuitively conceptualize a scenario in which an impact is noticeable (i.e., MODERATE) without being significant.

The term "destabilizing" is less nebulous than either of the terms "significant" or "noticeable", but it is still subjective. One definition of "destabilizing" is "to undermine or subvert … so as to cause unrest or collapse."[25] Another definition is "to upset the stability or smooth functioning of" something.[26] Both definitions focus on the concepts

of collapse or loss of function. Intuitively, the construction of a new housing development within the viewshed of a historic house may certainly result in noticeable (i.e., MODERATE) aesthetic impacts to visitors seeking to experience the historic ambience of the house's setting. But unless the housing development entails razing the house or acoustic effects capable of shattering the house's foundations, one could clearly argue that the impacts are not destabilizing to the house (i.e., LARGE impacts). But there is still an element of subjective interpretation. A dense and noisy housing development could so intrude on visual and acoustic senses that visitors could no longer understand or appreciate the historical context of the house. In contrast, a lower density development could be so screened as to have little effect at all on visitors to the house (perhaps reaching the level of only SMALL aesthetic impacts). Conversely, one could conclude that even impacts so severe as to result in the permanent loss of the house may only be MODERATE or SMALL if the house is not the last of its type or if its importance is not particularly noteworthy; in this context the loss of a house once belonging to a signer of the Declaration of Independence might be destabilizing (LARGE), while the loss of a house once belonging to a regional politician or tradesperson might only be noticeable (MODERATE) or even SMALL if other such houses remain in the region. Perhaps more obviously, one could interpret effects leading to the extinction (or elimination of that species from a region, i.e., regional extirpation) of a species as destabilizing (LARGE), while effects that substantially reduce the regional population of that species could only be MODERATE or even SMALL if regional distributions of wildlife and patterns of natural habitat remain substantially unchanged. In any event, distinguishing effects that are destabilizing from those that are just noticeable provides important information that could not be conveyed through simple designation as significant or not significant.

EXAMPLES OF USE OF NRC GRADUATED SIGNIFICANCE LEVELS

Table 2 presents multiple examples of how the three NRC significance levels of SMALL, MODERATE, and LARGE were used to evaluate terrestrial ecology impacts in a series of recently completed EISs addressuing the proposed licensing of new nuclear reactors.

The first example from Table 2 illustrates the use of SMALL as a conclusion for a new reactor project in South Carolina involving the loss of several hundred acres of terrestrial habitat containing only about 0.26 acre of wetlands and no Federal or state listed species or critical habitats. The reviewers supported their conclusion by stating "The affected terrestrial habitat types are common in the surrounding landscape, and much of the affected habitat consists of planted pine forest and successional vegetation on soils previous disturbed during development of [a previous nuclear reactor]"[27]. The reviewers note that wetland impacts would be mitigated (likely through purchasing credits from a local wetland mitigation bank[28])[29], and that population-level impacts on wildlife would be minimal.[30] For this analysis, the reviewers drew separate conclusions for the proposed reactor site and for the offsite impacts resulting from the need to build several long electric transmission lines to deliver the new electric output to the regional grid. The reviewers concluded that the the impacts from building the transmission lines would be MODERATE because they would involve a substantially greater and more diverse area of terrestrial habitats and wetlands.[31] The reviewers also concluded[32] that the overall terrestrial ecology impacts from building the overall project would also be MODERATE.[33] Although the FEIS does not directly state it, the reviewers' conclusions clearly suggest that the terrestrial ecology impacts on the site would not be significant, while the terrestrial ecology impacts from the transmission lines would be significant.

The second example from Table 2 likewise illustrates the use of SMALL to characterize several hundred acres of terrestrial habitat impacts on a proposed project site in Texas but the need for a MODERATE conclusion when characterizing offsite impacts from associated transmission lines. Building the reactor and other onsite facilities would disturb several hundred acres of previously disturbed land and land dominated by Ashe juniper (*Juniperus ashei*), a native but invasive plant of low habitat value that has expanded its range in Texas because of overgrazing and wildfire suppression.[34] Wetland impacts on the site would be limited to a portion of a small (less than one acre) stock pond and to a 0.78-acre littoral (shoreline) wetland at the edge of a man-made reservoir.[35] The reviewers assessed potential impacts to new transmission lines associated with the project based on the applicant's identification of broadly defined corridors within which

the transmission line developer would ultimately select exact rights-of-way.[36] The reviewers used a range of SMALL to MODERATE to characterize terrestrial ecology impacts from the project, "depending on the exact route ultimately selected for [one of the transmission lines]."[37] [38] They state that the potential for MODERATE impacts is limited only to the possibility that the right-of-way ultimately selected for one of the transmission lines might encompass lands containing habitat suitable for two Federally-listed bird species.[39]

As with the Summer FEIS, the Comanche Peak FEIS does not directly state whether terrestrial ecology impacts would be significant based on CEQ's traditional definition. It does however suggest that the terrestrial ecology impacts on the site would not be significant and that the significance of the transmission line impacts would depend upon final route. The reviewers do not use SMALL to MODERATE as an intermediate classification between SMALL and MODERATE; they instead use it to characterize the potential outcome of two separate possibilities: the possibility that the selected right-of-way crosses the subject habitat and the possibility that it does not. While a range of possible significance may not seem to be an ideal analytical objective, the reviewers decided that the indicated range, backed by the details presented in the text of the FEIS, provided enough information to support informed environmental decisionmaking and hence meet the objectives of NEPA.

The third example from Table 2 illustrates the use of SMALL to MODERATE to characterize several hundred acres of impacts to terrestrial habitats (roughly comparable in area to the plant site impacts from VC Summer and Comanche Peak) from the construction[40] of a third unit (Fermi 3) at the Fermi Nuclear Power Plant site in Michigan. Unlike VC Summer and Comanche Peak, the impacts at the Fermi 3 site would be substantial if not mitigated: they involve the loss of an estimated 197 acres of terrestrial habitat specifically managed for wildlife that includes over 34 acres of wetlands and that provide specialized habitat for a state-listed snake species, the eastern fox snake (*Elaphe gloydi*), and a state-listed plant species, American lotus (*Nelumbo lutea*).[41] The reviewers state that their conclusion is "based in part on [their] independent review of

mitigation measures proposed by [the applicant], especially the compensatory wetland mitigation required by [Federal and state agencies], mitigation for American lotus impacts … and [the applicant's] proposed mitigation measures for the eastern fox snake."[42] The implication is that without any mitigation, impacts could not be SMALL. They go on to state that "The potential for MODERATE impacts is limited to possible adverse effects on the eastern fox snake."[43] Although the reviewers relied on the successful implementation of the wetland mitigation, for which Federal law requires successful implementation backed by extended monitoring and adaptive management, they did not feel confident in assuming that the state would similarly ensure the success of the state-required mitigation for the eastern fox snake. The EIS uses a SMALL to MODERATE range similar to that used in the Comanche Peak EIS, but in this case the range is driven by the possible outcomes of proposed mitigation.

The fourth example from Table 2 illustrates the use of MODERATE to characterize several hundred acres of impacts from building a proposed reactor in central Florida to natural terrestrial habitats, including several hundred acres of wetlands and habitat suitable for multiple Federal and state-listed species. The reviewers states that their conclusion "reflects the impacts on wetlands, wildlife, and Federally and State-listed species…"[44] The reviewers acknowledge the extensive mitigation proposed by the applicant to address the terrestrial ecology impacts and demonstrate that the proposed wetland mitigation would provide the "functional lift" required to offset the wetland impacts using a functional assessment methodology widely recognized by state and Federal agencies that regulate wetland impacts in Florida.[45] Specifically, the proposed wetland mitigation involves "enchancing and restoring ecological functions to several hundred acres of wetland habitat and supporting uplands in each watershed affected by [the project]."[46] They state that even with the proposed mitigation, they believe that "the impacts to wetland and upland terrestrial habitats and their associated wildlife would still be noticeable in the surrounding landscape, especially in the short term."[47] However, the reviewers also explain that because of the proposed mitigation, the terrestrial ecology impacts " would not destabilize the continued existence of any wetland or upland habitats

and associated wildlife in the surrounding landscape."[48] As noted above, the ability of an impact to "destabilize" a resource is the inherent basis of a LARGE conclusion.

The reviewers recognize that most compensatory wetland mitigation of the type proposed for this project requires substantial time after initial implementation to achieve its stated goals. The US Army Corps of Engineers recognize this phenomenon as "temporal loss", defined as "the time lag between the loss of aquatic resource functions caused by the permitted impacts and the replacement of aquatic resource functions at the compensatory mitigation site."[49] Note that "replacement" refers to the replacement of "aquatic resource functions", not simply to establishment of compensatory wetland acreage.

None of the recently completed NRC new reactor EISs conclude that terrestrial ecology impacts for a proposed reactor would be LARGE. In most of the EISs, e.g., that for Fermi[50], LARGE impacts from the proposed reactors are limited to certain expected beneficial socioeconomic benefits attributable to the increased employment resulting from constructing and operating the new facilities. The conclusions for terrestrial ecology impacts from building the proposed Levy reactors indicate that without mitigation, the impacts could destabilize terrestrial resources.[51] The terrestrial ecology reviewers for the Fermi FEIS stated in written testimony for a hearing connected with the EIS that destabilizing (i.e., LARGE) impacts to a terrestrial species, the eastern fox snake, would have to be "capable of extirpating the species from a broad geographic area."[52] Under the traditional approach to significance determination in NEPA, a project that causes the loss of enough individuals of a species to be noticeable in the region and a project that causes regional extirpation of the species would both likely be termed "significant"; the NRC's three-grade system allows for one word conclusions that resolve this difference.

USE OF GRADUATED SIGNIFICANCE LEVELS TO COMPARE ALTERNATIVES

Although NRC's three-grade graduated approach clearly provides enhanced flexibility in characterizing the significance of impacts, it may also serve to further NEPA's decision-

making objectives. The CEQ Regulations emphasize that the section of an EIS comparing the effects of reasonable alternatives to a proposed agency action is the "heart" of the EIS[53] and that each EIS should:

> should present the environmental impacts of the proposal and the alternatives in *comparative form* [emphasis added], thus sharply defining the issues and providing a clear basis for choice among options by the decisionmaker and the public.[54]

Most EISs therefore contain a tabular comparison summarizing the effects of each alternative analyzed in detail. When carefully prepared, such tables can provide succinct summaries of impacts for each affected resource in a side-by-side format. CEQ states that the comparison of alternatives in an EIS must provide a "clear basis for choice among options by the decisionmaker and the public."[55] But even summary tables containing succinct summaries can be difficult to interpret. The reason is that there is no common quantifiable currency or metric for comparing the effects of different resources. A useful comparative metric used for land use might be acres; for water consumption, gallons; for socioeconomic issues, dollars or jobs; or for ecological impacts, acres of habitat or individuals of a species. Some resource areas such as aesthetics may not be capable of being expressed using in any quantitative metrics or even verifiable qualitative metrics (such as presence or absence of protected species or structures) and must therefore rely on subjective interpretations. The NRC new reactor EISs actually use multiple quantitative and qualitative metrics to characterize and draw significance conclusions for individual environmental resources. In the terrestrial ecology examples discussed above, the reviewers used a combination of affected habitat acreages (quantitative), affected wetland acreages (quantitative), population-level wildlife impacts (semi-quantitative), and occurrence of Federally and state-listed species (qualitative) to draw significance conclusions.

Consider, for example, the comparison of environmental impacts presented in the FEIS for the proposed two new VC Summer reactors (Table 3). The table suggests in a

visually impressive manner that land use, surface water use, surface water quality, groundwater quality, and terrestrial ecology are not meaningful comparators for the five sites.[56] However it suggests that one of the four alternative sites would result in substantially impacts with respect to groundwater use, aquatic ecology, and aesthetics and recreation. The reason for MODERATE groundwater use impacts at one of the alternative sites is that adequate groundwater withdrawals at that site, but not the other sites, could cause disruptive drawdowns at other nearby wells and could be difficult to sustain.[57] The reason for MODERATE aquatic impacts at one site versus SMALL impacts at the others is the possible presence of endangered and proposed endangered[58] fish species at that site.[59] Conversely, the table suggests that all of the four alternative sites would result in lesser impacts to historic and cultural resources than would the proposed site. The MODERATE impacts on the proposed site are associated with potential disturbance of four archaeological sites.[60]

However, despite its usefulness as a summary tool, the table (even when expanded to include all environmental resources) obscures several salient differences in the potential impacts among the sites. It does not indicate the reasons explained above for the differing significance conclusions; one would have to read the text to discover the reasoning. With respect to ecology, it obscures the meaningful fact that terrestrial ecology impacts at some of the sites would be minimized by optimal use of partially disturbed lands within sites already dedicated to operating energy generation facilities, while other sites are greenfield sites where the entire project would occupy lands without a history of previous industrial or urban disturbance. It provides no information as to whether the impacts are associated with the more intensive ground disturbance from building the reactor structures or from the lighter disturbances associated with building electric transmission lines. It provides no information as to whether the most substantial impacts are to upland or wetland habitats or involve threatened or endangered species. All such information is contained within the text of the EIS, but readers skimming the EIS for easily gleaned comparisons may be drawn only to the summary tables and never read of the meaningful differences conveyed only in the text.

Finally, one might wonder whether it could be possible to use the graduated significance conclusions presented in Table 3 to identify an environmentally preferable alternative. One might be tempted to conclude that Alternatives A, C, and D are environmentally preferable because impacts to all resources are SMALL for those alternatives other than for MODERATE impacts to two resources. This contrasts with MODERATE impacts to three resources for the proposed site and Alternative B. However, such a comparison would rest on two errant assumptions: first, that the graduated significance levels are based on a meaningful and additive common metric (somewhat analogous to the lowest common denominator used in the arithmetic of fractions) and second, that the resources are each of equivalent overall value.

Indeed, the FEIS concludes based on a holistic qualitative comparison of impacts to all environmental resources (not just ecology) that none of the sites are environmentally preferable.[61] It states "Although there are differences and distinctions between the cumulative environmental impacts of building and operating two new generating units at the VCSNS [proposed] site and the alternative sites, the review team concludes that none of these differences is sufficient to determine that any one of the alternative sites is environmentally preferable to the VCSNS site."[62] This statement reflects the significance differences reflected in Table 3 without attempting to extrapolate any definitive overall comparisons from such high-level resource-based summary comparisons.

To summarize, the ease of making comparisons using spectrum of multiple significance levels provides both an opportunity to improve how alternatives are compared in EISs and a possible pitfall. The pitfall is the temptation to rely too heavily on the designations and too little on the details of the underlying analyses. This may not be a serious problem when interpreting SMALL or LARGE designations reflecting trivial versus catastrophic impacts. But the MODERATE designation can cover a broad diversity of middling impacts. And those differences can clearly play a substantive role in making an informed choice among alternatives. Even when provided with comparisons using meaningfully resolvable graduated significance determinations, decision-makers must look beyond

one-word summary designations to truly understand the multifaceted character of the impacts.

OTHER ENVIRONMENTAL APPLICATIONS OF GRADUATED SCALES

While not common in the context of NEPA significance determinations, the use of graduated scales has considerable precedence in environmental science in other contexts. The demonstrated success of using graduated scales in these other contexts suggests that similar application to NEPA significance determinations, as is currently done by NRC, might be useful to decision-makers. Both of the examples presented below are outside the specific context of NEPA but apply to environmental issues that are frequently addressed in NEPA documents. In both examples, there are two contrasting poles to a spectrum for an environmental comparator, separated by one or more interim designations. In both cases, the availability of the interim designations provides increased flexibility to the analytical process. Both examples provide case studies of how graduated conclusory determinations have successfully enhanced environmental practice relevant to NEPA.

The first example involves wetland indicator statuses used to indicate the apparent preference of a plant species for wetland conditions. The indicator statuses of plant species in an area of vegetation are used to evaluate whether the vegetation is indicative of wetland conditions ("i.e., is hydrophytic vegetation"). The U.S. Fish and Wildlife Service (FWS) established five graduated statuses[63]. These statuses occur on a continuum from Obligate Wetland plants (OBL, occur almost always in wetlands) to Obligate Upland plants (UPL, occur almost always out of wetlands). The interim statuses use the term "facultative", which reflects the capacity of the ability of those plant species to grow either in or out of wetlands. The FWS formerly used the symbols "+" and "-" as modifiers to establish even more interim grades; use of the former indicated a slightly greater wetland habit than suggested by the unmodified status and use of the latter indicated a slightly lesser wetland habit (i.e., a slightly greater upland habit).[64] Drawing a parallel to the NRC three-stage significance system, one may view UPL plants as

displaying a SMALL indication of wetlands, the three "facultative" statuses (FACU, FAC, and FACW) as displaying a MODERATE indication of wetlands, and OBL plants as displaying a LARGE indication of wetlands.

Although the USFWS could have designated plant species as simply wetland or non-wetland (or upland) plants (analogous significant versus not significant), they recognized the need for meaningful interim statuses. For example, common cattail (*Typha latifolia*), which almost universally occurs in wetlands, has a status of OBL in the Atlantic and Gulf Coast Coastal Plain[65]. Common reed (*Phragmites australis*), which also occurs mostly in wetlands but commonly extends uphill into borderline areas and spoil piles, has a status of FACW, while red maple (*Acer rubrum*), which is common in both wetlands and uplands is FAC. All three species can be considered "wetland" plants, but the indicator statuses reflect the substantial variation in the preferences of the plants for wetlands versus uplands.

The graduated system of indicator statuses provides substantial practical function. The USACE has since 1987 instructed persons delineating wetlands subject to the Clean Water Act to identify the indicator statuses for each dominant plant species occupying part of a study area. According to what wetland delineators commonly refer to as the "Fifty Percent Rule", if more than fifty percent of the dominant plant species in an area have an indicator status of obligate, facultative wetland, or facultative, then that area supports hydrophytic vegetation. If plant species could only be designated as OBL or UPL without the intergraded facultative statuses, the resolution provided by the "Fifty Percent Rule" would not be available for wetland delineation.

The second example of graduated conclusions in wide use today is the system of conclusions used by the U.S. Fish and Wildlife Service (FWS) for evaluating effects on threatened and endangered species under the Endangered Species Act. Federal agencies proposing actions capable of affecting species listed under the Act must complete a consultation process with the FWS (termed the Section 7 consultation process, named after the section of the Act establishing the consultation process.[66] The FWS recognizes

a three-step gradient of possible effects of an action on a species: no effect (NE), is not likely to adversely affect (NLAA), and likely to adversely effect (LAA).[67] The NE conclusion typically reflects the absence of potentially suitable habitat or occurrence of the project outside of the known geographic range. The intermediate designation of NLAA reflects effects that "are expected to be discountable, or insignificant, or completely beneficial."[68] The LAA designation covers those adverse effects not meeting the limitations established for NLAA. The FWS provides additional but still vague and subjective guidance as to what is insignificant or discountable. Insignificant effects "relate to the size of the impact and should never reach the scale where take occurs."[69] "Take" is what the Endangered Species Act seeks to avoid; it is defined in the statute as "to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect [a listed species], or to attempt to engage in any such conduct."[70] Discountable effects are those extremely unlikely to occur."[71]

The FWS system offers considerably more information than would a more simplistic that recognized only possible effects (may affect) versus no possible effects (no effects). The difference between the two "may affect" designations (NLAA and LAA) is meaningful: a demonstration of NLAA successfully terminates the consultation process, while LAA necessitates a biological opinion. Mitigative actions are not needed in the case of NLAA to stave off possible extinction, while such actions could be necessary in the case of LAA. The graduated scale offers FWS a useful discriminator not available in a two step system.

CONCLUSIONS

Despite an EIS serving in essence as a comparative process for considering alternatives, NEPA practice relies heavily on the descriptive threshold termed significance. As traditionally used in a two-point discrete presence or absence framework (where impacts can be significant or not significant), the significance concept contributes little to the comparison of alternatives and decision-making objectives of NEPA. However, if it were possible to expand significance into a multigraded continuum of possible conclusions,

then it could serve as a useful summary indicator to use in making comparisons. The established process used by NRC to classify environmental impacts from nuclear reactor licensing activities as SMALL, MODERATE, or LARGE offers insight into how a such graduated continuum of significance determinations might work. It reveals advantages such as simplicity and ease of tabular comparison of alternatives. However, the NRC process also reveals possible pitfalls such as ease of misinterpretation and overreliance on high-level summary data. While there are few examples of other agencies using a graduated range of significance levels in NEPA, interesting parellels exist in long-used conclusory terminology used in the context of wetland delineation and the Endangered Species Act.

The experience from NRC's graduated significance levels and the use of graduated determination ranges in other environmental contexts suggests that more general application in the context of NEPA may be possible. However, agencies must carefully consider potential misapplications and issue clear guidance to ensure that use of graduated significance levels improves communication without inducing misinterpretation. Graduated significance levels could offer a valuable tool for interpreting significance and rapidly comparing alternatives. But agencies developing a process for using graduated significance levels must proceed with caution. Readers of EISs and other NEPA documents must not be misled into interpreting graduated significance levels quantitatively. Use of the graduated significance levels must not oversimplify comparisons; the significance levels must not serve as a crutch that diverts attention away from the underlying multifaceted details of the impact assessment. The process must not promote shallow comparisons.

Table 1
Comparison of NRC and Traditional NEPA Significance Levels

Traditional NEPA Significance Levels	NRC NEPA Significance Levels	Inherent Meaning of NRC Significance Levels
Not Significant	SMALL	Minor, Negligible
	MODERATE	Noticeable
Significant		
	LARGE	Destabilizing

Table 2
Examples of SMALL, MODERATE, and LARGE Conclusions; Reactor Construction Impacts on Terrestrial Ecology; NRC New Reactor EISs

EIS/Alternative	Conclusion	Basis	Notes
FEIS for VC Summer Units 2 and 3 Proposed Action	SMALL	Disturb approximately 556 ac of habitat on site. Loss of approximately 258 ac of forest. Roughly half of affected forest was planted pine. Fill 0.26 ac of wetland. No listed species.	Reviewers drew separate conclusions for site and transmission line impacts. Example addresses site impacts only. Transmission line impacts were more extensive and concluded to be MODERATE.
FEIS for Comanche Peak NPP Units 3 and 4	SMALL to MODERATE	Disturb approximately 675 ac on site consisting mostly of land dominated by invasive species and land previously disturbed to build older reactors. No listed species on site. Transmission lines would involve approximately 1103 ac, but most is crop and range land not substantially affected by installation of overhead conductors. Possible occurrence of two listed species depending on exact ultimate routing of transmission lines.	Potential for MODERATE impacts limited to transmission lines. Site impacts by themselves would be SMALL.
FEIS for Fermi	SMALL to	Disturb approximately 197 ac of	Conclusion represents a

Unit 3	MODERATE	terrestrial habitat, including over 34 ac of wetlands. Disturbed area provides habitat for state-listed threatened species.	range of uncertain outcome based on success of proposed mitigation: SMALL if mitigation is successful, MODERATE if not.
FEIS for Levy Units 1 and 2	MODERATE	Disturb approximately 777 ac of mostly forested land on site. Disturb approximately 450 ac of wetland. Single analysis for site and offsite (including transmission line) impacts. Numerous Federal and state-listed species affected.	Example addresses entire project including transmission lines. Impacts

Table 3
Comparison of Cumulative Impacts for Individual Resources for Alternative New Reactor Sites
Final EIS for Proposed VC Summer Units 2 and 3[1]

Resource Category[2]	VC Summer (Proposed) Site)	Alternative Site A[3]	Alternative Site B	Alternative Site C	Alternative Site D
Land Use	MODERATE	MODERATE	MODERATE	MODERATE	MODERATE
Surface Water Use	SMALL	SMALL	SMALL	SMALL	SMALL
Groundwater Use	SMALL	SMALL	MODERATE	SMALL	SMALL
Surface Water Quality	SMALL	SMALL	SMALL	SMALL	SMALL
Groundwater Quality	SMALL	SMALL	SMALL	SMALL	SMALL
Terrestrial Ecology	MODERATE	MODERATE	MODERATE	MODERATE	MODERATE
Aquatic Ecology	SMALL	SMALL	MODERATE	SMALL	SMALL
Historic and Cultural Res.	MODERATE	SMALL	SMALL	SMALL	SMALL

Table 4

[1] Adapted from Table 9-35 on Page 9-202 of Final EIS for Combined Licenses for Virgil C. Summer Nuclear Station Units 2 and 3
[2] The full table also addressed multiple socioeconomic issues, environmental justice, aesthetics and recreation, air quality, non-radiological health, radiological impacts, and postulated accidents.
[3] The FEIS specified actual names for each site; the simplified names used here are intended to focus the reader on comparative elements in the table.

Theoretical Application of Hypothetical Five-Graded Significance Scale

Resource	SMALL	MODERATE -	MODERATE	MODERATE +	LARGE
Land Use	Abundant buildable land, no land use conflicts	Limited buildable land but no conflicts in foreseeable future	Potentially noticeable conflicts for buildable land to extent that future development options could be limited	Conflicts with regional comprehensive plans but could be adapted into a modified plan	Conflicts with regional comprehensive plans and would severely limit future development options
Ecology	No adverse effects on listed species; no widespread effects on general pattern of habitat distribution in surrounding landscape	No adverse effects on listed species but could alter patterns of wildlife migration over surrounding landscape	Could adversely affect listed species; could noticeably alter wildlife migration patterns over surrounding landscape in short term	Could adversely affect listed species; require incidental take permit, could severely alter wildlife migration patterns over surrounding landscape in short term	Could jeopardize listed species with extinction or could severely and permanently alter wildlife migration patterns over surrounding landscape.

[1] 42 USC 4321 *et seq*.
[2] 42 USC 4332
[3] 40 CFR 1508.4
[4] 40 CFR 1508.9
[5] 40 CFR 1508.27
[6] 490 U.S. 360, Marsh v. Oregon Natural Resources Council (1989), available at http://supreme.justia.com/cases/federal/us/490/360/, Quoted from "Syllabus".
[7] 10 CFR 51, Subpart A, Appendix B
[8] Doub, J. P, 2014, Uses of Tiered Significance Levels in NEPA Documents, Oral presentation at 39th Annual Conference of the National Association of Environmental Professionals, April 10, 2014, Tampa, Florida.
[9] 42 USC 4331(1)(C)
[10] 40 CFR 1508.4
[11] 40 CFR 1508.9
[12] 40 CFR 1508.13
[13] 40 CFR 1508.27
[14] 40 CFR 1508.27(a)
[15] 40 CFR 1508.27(b)
[16] http://www.merriam-webster.com/dictionary/significant

[17] StatPac website for Survey Software for Online, Web, and Paper Surveys, Crosstabs, and Banner Tables, Statistical Significance page, Available at http://www.statpac.com/surveys/statistical-significance.htm.
[18] 7 U.S.C. 136, 16 U.S.C. 1531 *et seq*.
[19] National Marine Fisheries Service, October 2010, Interim Endangered and Threatened Species Recovery Planning Guidance, Version 1.3, Silver Spring, Maryland, Originally published October 2004 and updated in 2006, 2007, and 2010, Available at http://www.nmfs.noaa.gov/pr/pdfs/recovery/guidance.pdf.
[20] Interim Endangered and Threatened Species Recovery Planning Guidance, p. 5.1-15.
[21] 40 CFR 1502.14
[22] One must however recognize that NEPA does not require that agencies base their decisions only upon environmental considerations.
[23] 40 CFR 1500.1
[24] http://dictionary.reference.com/browse/noticeable.
[25] http://dictionary.reference.com/browse/destabilize.
[26] http://www.thefreedictionary.com/destabilize.
[27] US Nuclear Regulatory Commission and US Army Corps of Engineers, April 2011, Final Environmental Impact Statement for Combined Licenses for Virgil C. Summer Nuclear Station Units 2 and 3 (Summer FEIS), Final Report, US Nuclear Regulatory Commission, Washington DC, Office of New Reactors, Washington, DC and Regulatory Division, Special Projects Branch, Charleston District, US Army Corps of Engineers, Charleston, SC, NUREG-1939, p. 4-30.
[28] A wetland mitigation bank is a project where a party (usually for-profit) creates, restores, or enhances wetlands and receives approval from wetland permitting agencies (U.S. Army Corps of Engineers or state agencies) to sell credits to developers for the purpose of satisfying wetland mitigation requirements established by permits.
[29] Summer FEIS, p. 4-22.
[30] Summer FEIS, pp. 4-30 to 4-31.
[31] Summer FEIS, pp. 4-31.
[32] Most of the recently issued NRC new reactor EISs present two separate conclusions regarding the impacts from constructing a new reactor to each environmental resource. The first conclusion refers to the impact from the building the totality of the new reactor project. The second conclusion refers only to those construction activities defined as NRC-authorized construction in 10 CFR 50.10(a). The NRC-authorized construction activities constitute only a subset of the total construction activities. The remaining construction activities are termed "preconstruction" by the NRC and are accounted for in the first conclusion as well as in the cumulative impacts determination. The definition of NRC-authorized construction is not the subject of this paper and is not addressed further. For this and other examples drawn from the construction chapters of NRC EISs, the discussion pertains only to the conclusions drawn for the more inclusive consideration of construction activities.
[33] Summer FEIS, p. 4-31.
[34] US Nuclear Regulatory Commission and US Army Corps of Engineers, May 2011, Final Environmental Impact Statement for Combined Licenses for Comanche Peak Nuclear Power Plant Units 3 and 4 (Comanche Peak FEIS). Final Report, US Nuclear Regulatory Commission, Washington DC, Office of New Reactors, Washington, DC and Regulatory Branch, Planning, Environmental, and Regulatory Division, US Army Engineer District Fort Worth, US Army Corps of Engineers, Fort Worth, TX, NUREG-1943, p. 4-15.
[35] Comanche Peak FEIS, pp. 4-27 to 4-28.
[36] The transmission line is not directly part of the power plant project and would be developed by a separate party independent of the applicant. The company responsible for the transmission lines would design the transmission line only once power delivery is imminent. The agencies preparing the EIS therefore could only evaluate the combined effects of the power plant and transmission lines based on the applicant's identification of broadly-defined corridors within which the rights-of-way would ultimately be defined.
[37] Comanche Peak FEIS, p. 4-25 to 4-26.
[38] See note above regarding NRC definition of construction
[39] Comanche Peak FEIS, p. 4-26
[40] See note above regarding NRC definition of construction
[41] US Nuclear Regulatory Commission and US Army Corps of Engineers, April 2012, Final Environmental Impact Statement for the Combined License for Enrico Fermi Unit 3 (Fermi FEIS), Final Report, US

Nuclear Regulatory Commission, Washington DC, Office of New Reactors, Washington, DC and Regulatory Office, Permit Evaluation, Eastern Branch, US Army Engineer District, Detroit, US Army Corps of Engineers, Detroit, MI, pp. 4-23 to 4-26 and 4-31 to 4-43.
[42] Fermi EIS, p. 4-47
[43] Fermi EIS, p. 4-47
[44] US Nuclear Regulatory Commission and US Army Corps of Engineers, April 2012, Final Environmental Impact Statement for Combined Licenses for Levy Nuclear Plant Units 1 and 2 (Levy FEIS), Final Report, US Nuclear Regulatory Commission, Washington DC, Office of New Reactors, Washington, DC and Regulatory Division, Jacksonville District, US Army Corps of Engineers, Jacksonville, FL, NUREG-1941, p. 4-71.
[45] Levy FEIS, pp. 4-67 to 4-70.
[46] Levy FEIS, p. 4-68
[47] Levy FEIS, p. 4-71
[48] Levy FEIS p. 4-71
[49] 33 CFR 332.2
[50] Fermi EIS, pp. 4-78 to 4-79 and pp. 5-86 to 5-87.
[51] Levy FEIS, p. 4-71
[52] NRC Staff Pre-Filed Direct Testimony of J. Peyton Doub and David A. Weeks Regarding Contention 8, ML 13088A486, March 29, 2013, A21, Page 24.
[53] 40 CFR 1502.14
[54] 40 CFR 1502.14
[55] 40 CFR 1502.14
[56] To avoid distraction, generic names were substituted for the actual names of the alternative sites in the table and this text.
[57] VC Summer FEIS, p. 9-94.
[58] Before being officially listed as endangered or threatened under the Endangered Species Act, species must first be proposed for listing in the Federal Register and the public be offered an opportunity to comment.
[59] VC Summer FEIS, pp. 9-101 to 9-106.
[60] VC Summer FEIS, pp. 4-70 to 4-73.
[61] VC Summer FEIS, pp. 9-203 to 9-206.
[62] VC Summer FEIS, p. 9-206.
[63] Reed, P. B., Jr., 1988, National list of plant species that occur in wetlands: national summary, U.S. Fish Wildl. Serv. Boil. Rep. 88(24), 244pp. The U.S. Army Corps of Engineers issued a new list in May 2012, termed the National Wetland Plant List, that superceded the 1988 list for purposes of regulatory wetland delineation. The most recent update to the National Wetland Plant List, dated May 2014, is available at http://www.usace.army.mil/Portals/2/docs/civilworks/regulatory/nwpl/nwpl_factsheet_4Apr2014.pdf. It uses the same five wetland indicator statuses as the 1988 list but reflects updated information about the plant species and does not use the "+" and "-" indicators.
[64] Reed, P. B., Jr., 1988. National list of plant species that occur in wetlands: national summary, U.S. Fish Wildl. Serv. Boil. Rep. 88(24), 244pp.
[65] Lichvar, R.W., M. Butterwick, N.C. Melvin, and W.N. Kirchner, 2014, The National Wetland Plant List: 2014 Update of Wetland Ratings, Phytoneuron 2014-41: 1-42.
[66] Procedures for the Section 7 consultation process are established in 50 CFR 402.
[67] US Fish and Wildlife Service and National Marine Fisheries Service, 1998, Endangered Species Act Consultation Handbook, Procedures for Conducting Section 7 Consultations and Conferences (Section 7 Consultation Handbook), March, Final.
[68] Section 7 Consultation Handbook, p. 3-12.
[69] Section 7 Consultation Handbook, p. 3-12.
[70] 16 USC 1532(19).
[71] Section 7 Consultation Handbook, p. 3-12.